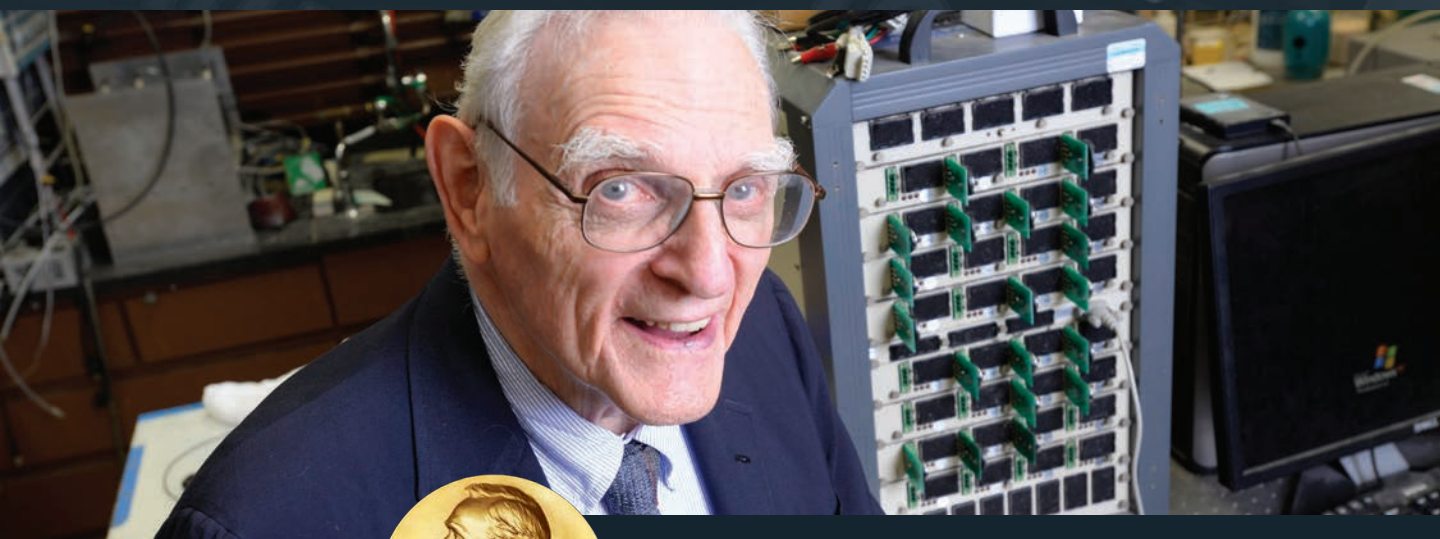




The University of Texas at Austin
**Electrical and Computer
Engineering**

Cockrell School of Engineering

IMPACT REPORT 2019



Prof. John Goodenough wins the Nobel Prize in Chemistry
for the development of lithium-ion batteries



Dr. Ahmed Tewfik
Outgoing Department Chair

October 9, 2019 was a great day for our department. Our colleague John Goodenough received the Nobel Prize in Chemistry. John holds appointments in our department and the department of Mechanical Engineering. He epitomizes the traits we seek in our faculty and strive to inculcate in our students. His creativity and inventiveness are legend and his invention of the lithium-ion battery continues to enhance the quality of life for billions across the globe. His relentless pursuit of multidisciplinary collaborations and dialogs has resulted in many more inventions, including a potential solid state battery technology that may again revolutionize how we live, travel and communicate. Above all, his dedication to mentoring his colleagues and our students is a shining example to all of us.

In this past year, we continued to implement our vision of becoming a premier source of diverse disruptive innovators and innovations.

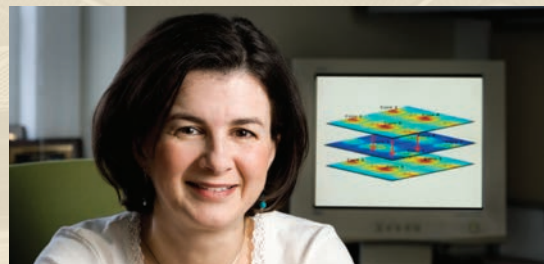
To form the next John Goodenough, we continue to innovate in our delivery of education and pursuit of research with potentially high societal impact. For the first time in our history, we offered this past academic year an undergraduate circuit design course in collaboration with TSMC that enabled undergraduate students to fabricate and test their designs. This course is to our knowledge unique. Together with the college of pharmacy, the department organized a "One Day Startup" camp for our students. The camp brought together students from engineering, pharmacy, natural sciences, the medical school, and business. The student feedback and the paths that some of our students took the summer and fall indicates that it was a very successful and cross-disciplinary event. We conducted our first survey of undergraduate and graduate ECE students, which focused on their opinions and approaches to learning, and we followed up with another survey this month. The results of these two surveys will enable us to optimize instruction delivery. We continue to obsess with ensuring that our students integrate the deep technical foundation that they may perceive as disparate, liberal arts, communications, presentations and interpersonal skills and ability to take calculated risks.

The department successfully led several interdisciplinary initiatives within the University in this past year. Two of our major successes were establishing the robotics consortium and the computing consortium. Both are described in this report. The robotics consortium garnered substantial

funding from the US Army futures command this past year, a clear indication of our success in establishing a premier national program in a very short period of time. The computing consortium presents to our internal and external constituencies and stakeholders an integrated and unified picture of our strengths, capabilities and activities in computing across UT. It is also leading to tighter integration of research and teaching activities across all units, in particular, computer science and electrical and computer engineering. Our faculty continues to win prestigious awards and recognitions and maintain a very high visibility in professional venues and the national and international media. Our external research expenditures have increased by an impressive 30% since the academic year 2013 – 2014.

This will truly be my last message to you as chairman of this great department. I would like to take this opportunity to thank all of you, our students, staff, faculty, friends, partners and alumni one final time for your dedication and generous time and financial support! I was privileged to live for the past nine years the story of your commitment and successes.

Prof. Diana Marculescu, who has served on the faculty at Carnegie Mellon for nearly two decades and is a pioneer in energy-aware computing, will be joining us as our new chair on December 1, 2019. I know that Diana will continue to advance our department and strengthen our programs in the years ahead.



Dr. Diana Marculescu
Incoming Department Chair

I am truly honored and privileged to write this first message as the next chair of the department. I am joining the department after spending the majority of my career at Carnegie Mellon University, more recently as associate head and founding director of the Center for Faculty Success, an umbrella organization for faculty development. I am thrilled to join a department with a wonderful scholarly reputation and use my background in the service of furthering its mission. The state of the department is first-rate, due in no small part to the leadership of Prof. Tewfik and the outstanding contributions of the department's faculty, staff, students, supporters and alumni. In my new role, I will do my utmost to make the department the best it can be and support everyone in achieving their hopes and dreams as members of the ECE community. I am excited to join now, when our discipline is in a unique position to solve global challenges facing our society. Together we can truly make ECE a discipline in service of the common good, while building a community that is inclusive and values diversity in people, cultures and opinions.



NOBEL PRIZE

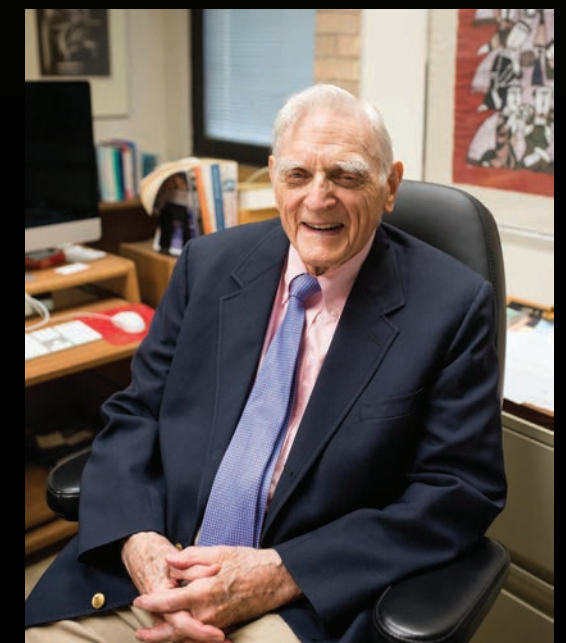
John B. Goodenough, professor in the Cockrell School of Engineering at The University of Texas at Austin, has been awarded the 2019 Nobel Prize in chemistry — jointly with Stanley Whittingham of the State University of New York at Binghamton and Akira Yoshino of Meijo University — “for the development of lithium-ion batteries.”

rich materials that allow for the use of stable and manageable negative electrodes in lithium-ion batteries.

At 97 years old, Goodenough continues to push the boundaries of materials science with the goal of inventing more sustainable and energy-efficient battery materials. Goodenough and his team recently identified a new safe cathode material for use in sodium-ion batteries.

In the words of the Nobel Foundation, “Through their work, they have created the right conditions for a wireless and fossil fuel-free society, and so brought the greatest benefit to humankind.”

Goodenough, who was born in 1922, identified and developed the critical materials that provided the high-energy density needed to power portable electronics, initiating the wireless revolution. Today, batteries incorporating Goodenough's cathode materials are used worldwide for mobile phones, power tools, laptops, tablets and other wireless devices, as well as electric and hybrid vehicles. In 1979, Goodenough showed that by using lithium cobalt oxide as the cathode of a lithium-ion rechargeable battery, it would be possible to achieve a high density of stored energy with an anode other than metallic lithium. This discovery led to the development of carbon-



UNDERGRADUATE PROGRAM

U.S. News & World Report
PROGRAM RANKINGS

#10 **ELECTRICAL
ENGINEERING
PROGRAM**

#8 **COMPUTER
ENGINEERING
PROGRAM**



1,619

UNDERGRADUATE STUDENTS

TOTAL **18%** FEMALE STUDENTS INCOMING

TOTAL **17%** UNDERREPRESENTED MINORITIES INCOMING

26.6% **ADMISSION
RATE**



UNDERGRADUATE STUDENTS BY TECHNICAL CORE*

*Represents completed tech core elections

ELECTRICAL ENGINEERING 25%

Communications, Signal Processing, Networks & Systems	4.2%
Electronics & Integrated Circuits	11.3%
Energy Systems & Renewable Energy	6.1%
Fields, Waves & Electromagnetic Systems	1.0%
Nanoelectronics & Nanotechnology	2.1%

COMPUTER ENGINEERING 75%

Computer Architecture & Embedded Systems	17.9%
Software Engineering & Design	52.5%
Data Science & Information Processing	4.9%

RESEARCH EXPENDITURES (2018-2019)

\$23,894,860

TOTAL RESEARCH EXPENDITURES **↑28%**
PAST FIVE YEARS

EXTERNALLY FUNDED RESEARCH EXPENDITURES **↑30%**
PAST FIVE YEARS

FACULTY

68 **TENURED AND
TENURE-TRACK
FACULTY**

CURRENT FACULTY INCLUDES:

2 **ACM
FELLOWS**

3 **NAE
MEMBERS**

30 **IEEE
FELLOWS**

“We believe that diversity is a fundamental part of engineering education and the engineering profession.”

- Dean Sharon Wood

GRADUATE PROGRAM

U.S. News & World Report
PROGRAM RANKINGS

#9 **ELECTRICAL
ENGINEERING
PROGRAM**

#7 **COMPUTER
ENGINEERING
PROGRAM**



682

GRADUATE STUDENTS

438

PHD STUDENTS

244

MS STUDENTS

21.0% **ADMISSION
RATE**



GRADUATE STUDENTS BY PRIMARY RESEARCH AREA

Architecture, Computer Systems & Embedded Systems	16.1%	Integrated Circuits & Systems	19.7%
BioECE	3.4%	Plasma/Quantum Electronics & Optics	3.9%
Decision, Information & Communications Engineering	21.8%	Software Engineering & Systems	8.0%
Electromagnetics & Acoustics	3.9%	Solid-State Electronics	12.8%
Energy Systems	10.4%		

DIVERSITY & INCLUSION



Texas ECE professor **Christine Julien** was named the assistant dean for diversity, equity, and inclusion. In her new role as assistant dean, Julien intends to work closely with all of the school's diversity programs and groups to build a cohesive strategy and a supportive environment where all engineering faculty, staff and students feel like they belong and can thrive.

OUTREACH & ADVISING

The Texas ECE advising office was recognized by the National Academic Advising Association (NACADA) with the 2019 NACADA Outstanding Advising Program award. The award recognizes the dedication and creativity of our staff and the innovative programs that have been implemented in the department and are being adopted by others.



COMPUTING

Texas Computing Initiative Harnesses Cutting-edge Resources

To better capture the combined resources of the university, UT Austin launched **Texas Computing**, an initiative geared at making the assets and linkages among departments and research centers more apparent.

The effort is led by six units, housed across numerous colleges at the University: **Computer Science, Electrical and Computer Engineering, the School of Information, the Oden Institute for Computational Science and Engineering, the Department of Statistics & Data Science, and the Texas Advanced Computing Center (TACC).**

“We have world-class researchers advancing computing from the level of the atom to the algorithm to the application, and with Texas Computing, our strengths and the connections among our departments are more visible.”

SMART HOMES

Advancing an Intelligent Environment

Over the past few years, UT Austin has made significant progress to strengthen multidisciplinary research and scholarship efforts by enabling the campus to devote a critical mass of faculty to areas of knowledge that can only be addressed across existing departmental structures.

The “**Smart Homes—Smart Health**” project aims to develop techniques and approaches to realize the vision of smart homes as hosts for intelligent agents that can monitor and understand health, environment, and behavior. The idea is to take a system view of smart homes to both sense in the smart home space and adapt the intelligent system to improve the life and wellbeing of residents. Potential target research areas include activity recognition, the Internet of Things, sensing and tracking, cyber-physical-human systems, mobile and wearable computing. We are particularly interested in promoting aging in



place and/or independent living for people with disabilities, with an eye towards families and homes in underserved communities.

This is a joint effort with the **Department of Civil, Architecture and Environmental Engineering, the Whole Communities - Whole Health Bridging Barriers Initiative, and the Dell Medical School's Department of Neurology.**

ROBOTICS

Texas Robotics Creates Multidisciplinary Exchange

The Robotics Consortium is a new initiative from UT Austin that seeks to forge a close relationship between university faculty and graduate students in robotics and our natural partners in industry. Due to fundamental advances across multiple disciplines, robotics will be a huge growth area over the coming years, both academically and economically. The Robotics Consortium seeks to capitalize on that growth by creating an exchange in which affiliate partners benefit from access to cutting edge knowledge capital and top talent while the university gains a clearer understanding of the practical challenges confronting industry and a market for its graduates.

“The idea of Robotics Consortium is to provide a structure for us to collaborate at a higher frequency, so we are able to do bigger projects that span multiple departments and leverage the expertise of those professors.”

Army Futures Command Robotics Research Space

As part of The UT Board of Regents' partnership with **Army Futures Command**, The University of Texas at Austin will spend \$24.5 Million to create a 55,240-square-foot **Robotics Research Space** to be used by the Army Futures Command modernization program, which will continue to develop robotic, positioning and navigational technologies.

“It will be a truly immersive environment for cross-functional teams connecting our academic programs with the Army's subject matter experts, modernization initiative, and partners who can take new technology to the commercial market space. Faculty and students will bring research skills to bear on key problems the Army must solve, and the space will allow teams to produce and test prototypes faster.”

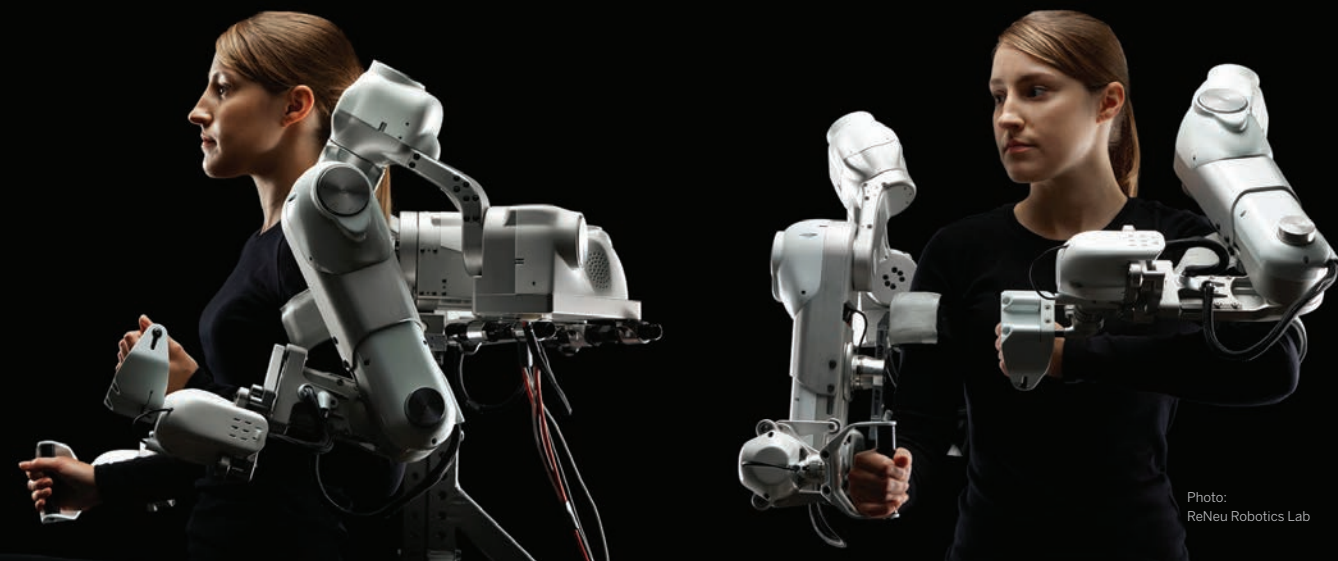
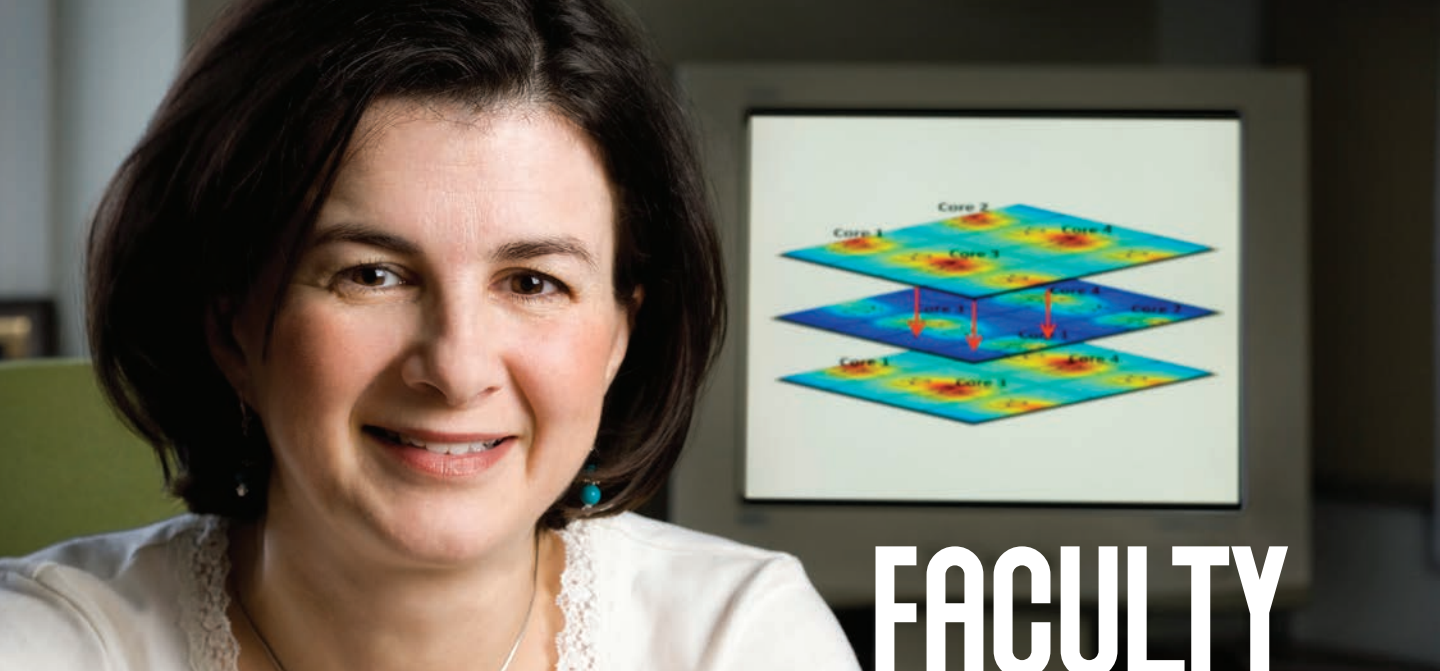


Photo: ReNeu Robotics Lab



ACADEMICS

FACULTY

Integrating Coursework to Accelerate Learning

Profs. **Milos Gligoric** and **Jonathan Valvano** will teach special integrated sections of courses in Software Design and Implementation and Embedded Systems. Because topics of classes overlap, pairing courses and teaching them concurrently accelerates the students' knowledge of the material. Topics introduced in one class can be reinforced in the other. Taking certain courses early in an academic career also improves chances for the students to obtain competitive internships. Texas ECE also identified a need for students to experience writing for engineering and the study of ethics in engineering from the moment they begin their education. Texas ECE has vertically integrated writing and ethics education to create an ongoing learning experience to continue throughout their entire degree program.



Startup Course Emphasizes Multidisciplinary Work

Texas ECE recognizes the significance of multidisciplinary and entrepreneurial experience for our students. In the Startup section of the Capstone Design Course, students create a project and business plan for a potential startup company. The Startup program is open not only to Texas ECE students but to students from other engineering departments as well. Innovators from outside the ECE department are sought out to bring their ideas to our engineering students to help realize their vision. In the future, project teams will also collaborate with design students to help them develop their user interfaces. Along with ECE students, students from Aerospace Engineering, Chemical Engineering, and Computer Science are participating in this year's Startup course.

First-Year Design Experience Introduces Students to Hands-On Design

First-Year Design Experience (FDE) is a two semester "bite-sized" course where students form groups of five and use the conceptual topics they are being taught to design components, bigger components, and, finally, systems. It is a combination of a top-down and bottom-up learning approach that introduces them to a hands-on design experience they will use throughout their academic careers.

Introducing Our New Chair

Diana Marculescu

Renowned Carnegie Mellon University researcher and professor **Diana Marculescu** becomes the next chair of UT's Department of Electrical and Computer Engineering in December 2019. Marculescu will join UT after serving on the faculty at Carnegie Mellon for nearly two decades.

New Faculty



Alex Hanson
Assistant Professor
Power electronics



Radu Marculescu
Professor
Optimization of systems



Aryan Mokhtari
Assistant Professor
Optimization and machine learning



Shyam Shankar
Assistant Professor
Quantum information science and engineering



Hyeji Kim
Assistant Professor
Information theory and machine learning



José del R. Millán
Professor
Brain-machine interface



Emily Porter
Assistant Professor
Electromagnetics and healthcare applications



Jonathan Tamir
Assistant Professor
Machine learning

“In this past year, we continued to implement our vision of becoming a premier source of diverse disruptive innovators and innovations.”



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Department of Electrical and Computer Engineering
The University of Texas at Austin
2501 Speedway, Austin, TX 78712
ece.utexas.edu